

WHAT IS CLAIMED IS:

1. An optical communication device, comprising:  
an integrated circuit operable to generate a plurality of optical signal wavelengths, the integrated circuit comprising:  
5 a plurality of light sources, each light source operable to generate at a specified wavelength an unmodulated optical signal; and  
a plurality of modulators, each modulator coupled to at least one of the plurality of light sources and operable to modulate information onto the unmodulated optical signal based at least in part on an electronic signal to form a plurality of  
10 modulated optical output wavelength signals.
2. The optical communication device of Claim 1, further comprising one or more controllers operable to generate the electronic signal used to modulate the unmodulated optical signal.  
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3. The optical communication device of Claim 2, wherein the one or more controllers are further operable to receive a plurality of input wavelength signals and to convert the plurality of input wavelength signals to a plurality of electronic signals for use in modulating the unmodulated optical signals.  
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4. The optical communication device of Claim 2, wherein the one or more controllers, the plurality of light sources, and the plurality of modulators reside on a semiconductor substrate.
- 25 5. The optical communication device of Claim 2, wherein integrated circuit further comprises one or more receivers coupled to the controller.
6. The optical communication device of Claim 5, wherein at least one of the receivers is operable to convert one of the optical signal wavelengths to an  
30 electronic format for communication to the controllers.

7. The optical communication device of Claim 1, further comprising an optical signal separator operable to receive a multiple wavelength optical input signal and to separate that signal into a plurality of optical input wavelength signals.

5           8. The optical communication device of Claim 7, wherein at least one of the plurality of optical input signal wavelengths comprises a packet comprising the identifier associated with the destination element external to the optical processing device.

10           9. The optical communication device of Claim 8, wherein the packet comprises an Internet Protocol (IP) packet or a Transmission Control Protocol (TCP) packet.

15           10. The optical communication device of Claim 8, wherein the packet comprises a Multi-Protocol Label Switching (MPLS) or a Generalized Multi-Protocol Label Switching (GMPLS) packet.

20           11. The optical communication device of Claim 7, wherein the separator is a device selected from the group consisting of a wavelength division demultiplexer, a wavelength grating router, and an arrayed wavelength grating.

25           12. The optical communication device of Claim 1, wherein at least some of the plurality of optical output wavelength signals comprises a different center wavelength.

            13. The optical communication device of Claim 1, wherein at least some of the plurality of light sources are selected from the group consisting of fixed wavelength lasers and tunable lasers.

30           14. The optical communication device of Claim 1, wherein at least some of the plurality of light sources are selected from the group consisting of laser diodes and light emitting diodes.

15. The optical communication device of Claim 1, further comprising a combiner operable to receive each of the modulated optical output wavelength signals and to generate a multiple wavelength output optical signal.

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16. The optical communication device of Claim 15, wherein the combiner comprises a wavelength division multiplexer.

17. The optical communication device of Claim 1, wherein the optical  
10 communication device comprises a router.

18. An optical communication device, comprising:  
a plurality of integrated circuits operable to receive at least some of a plurality  
of optical signal wavelengths, each of the plurality of integrated circuits comprising:  
one or more controllers operable to convert at least a portion of each  
5 optical signal wavelength received by the integrated circuit to an electronic signal;  
and  
a plurality of optical transmitters, each optical transmitter operable to  
generate an optical output wavelength signal based at least in part on the electronic  
signal received from the one or more controllers.

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19. The optical communication device of Claim 18, wherein the one or  
more controllers are further operable to receive a plurality of input wavelength signals  
and to convert the plurality of input wavelength signals to a plurality of electronic  
signals for use in modulating the optical output wavelength signals.

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20. The optical communication device of Claim 18, wherein the one or  
more controllers and the plurality of optical transmitters reside on a semiconductor  
substrate.

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21. The optical communication device of Claim 18, wherein integrated  
circuit further comprises one or more receivers coupled to the controller.

22. The optical communication device of Claim 21, wherein at least one of  
the receivers is operable to convert one of the optical wavelength signals to an  
25 electronic format for communication to the controllers.

23. The optical communication device of Claim 18, further comprising an  
optical signal separator operable to receive a multiple wavelength optical input signal  
and to separate that signal into a plurality of optical input wavelength signals.

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24. The optical communication device of Claim 23, wherein at least one of  
the plurality of optical input signal wavelengths comprises a packet comprising the

identifier associated with the destination element external to the optical processing device.

25. The optical communication device of Claim 24, wherein the packet  
5 comprises an Internet Protocol (IP) packet or a Transmission Control Protocol (TCP) packet.

26. The optical communication device of Claim 24, wherein the packet  
comprises a Multi-Protocol Label Switching (MPLS) or a Generalized Multi-Protocol  
10 Label Switching (GMPLS) packet.

27. The optical communication device of Claim 23, wherein the separator  
is a device selected from the group consisting of a wavelength division demultiplexer,  
a wavelength grating router, and an arrayed wavelength grating.  
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28. The optical communication device of Claim 18, wherein at least some  
of the optical output wavelength signals comprise a different center wavelength.

29. The optical communication device of Claim 18, wherein the one or  
20 more controllers are further operate to convert at least a header and a payload portions  
associated with each optical wavelength signal to the electronic signal.

30. The optical communication device of Claim 18, wherein the one or  
more controllers operate to generate communication instructions for each optical  
25 wavelength signal based at least in part on a destination identifier associated with the  
electronic signal.

31. The optical communication device of Claim 18, wherein the portion of  
the optical wavelength signal converted to the electronic signal comprises a  
30 destination identifier.

32. The communication device of Claim 18, wherein at least some of the plurality of optical transmitters comprise:

a light source operable to generate at a specified wavelength an unmodulated optical signal; and

5 a modulator coupled to the light source and operable to modulate information onto the unmodulated optical signal based at least in part on the electronic signal to form a plurality of modulated optical output wavelength signals.

33. The communication device of Claim 32, wherein the light source is  
10 selected from the group consisting of fixed wavelength lasers and tunable lasers.

34. The communication device of Claim 32, wherein the light source is selected from the group consisting of laser diodes and light emitting diodes.

15 35. The communication device of Claim 18, further comprising a combiner operable to receive each of the optical output wavelength signals and to generate a multiple wavelength output optical signal.

36. An optical communication device, comprising:

an integrated circuit operable to receive a plurality of input optical signal wavelengths and to generate a plurality of output optical signal wavelengths, the integrated circuit comprising:

5 one or more receivers operable to convert one of the input optical signal wavelengths to an electronic format;

a plurality of light sources, each light source operable to generate at a specified wavelength an unmodulated optical signal; and

10 a plurality of modulators, each modulator coupled to at least one of the plurality of light sources and operable to modulate information onto the unmodulated optical signal based at least in part on the electronic format; and

37. The optical communication device of Claim 36, wherein the one or more receivers are further operable to communicate the electronic format to one or  
15 more controllers.

38. The optical communication device of Claim 37, wherein the one or more controllers operate to convert the electronic format to an electronic signal for use in modulating the unmodulated optical signal.  
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39. The optical communication device of Claim 37, wherein the one or more controllers, the plurality of light sources, and the plurality of modulators reside on a semiconductor substrate.

25 40. The optical communication device of Claim 36, further comprising an optical signal separator operable to receive a multiple wavelength optical input signal and to separate that signal into the plurality of optical input wavelength signals.

30 41. The optical communication device of Claim 40, wherein at least one of the plurality of optical input signal wavelengths comprises a packet comprising the identifier associated with the destination element external to the optical processing device.

42. The optical communication device of Claim 36, wherein at least some of the plurality of optical output wavelength signals comprises a different center wavelength.

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43. The optical communication device of Claim 36, wherein at least some of the plurality of light sources are selected from the group consisting of laser diodes and light emitting diodes.

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44. The optical communication device of Claim 36, wherein the line card further comprises one or more controllers operable to convert at least a portion of each optical input wavelength signal to an electronic signal.

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45. The optical communication device of Claim 44, wherein the portion of the optical input wavelength signal converted to the electronic signal comprises a destination identifier.

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46. The optical communication device of Claim 44, wherein the one or more controllers operate to generate communication instructions for each optical input wavelength signal based at least in part on a destination identifier associated with the electronic signal.

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47. The optical communication device of Claim 36, further comprises a look-up table operable to facilitate generation of at least a first control signal based at least in part on an identifier.